Effect of fire on Buttongrass Pond Ecology at Derwent Bridge

Interim report

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Peter Davies, Laurie Cook, Tom Sloane

1. Background

This report documents the results of benthic faunal surveys of ponds in buttongrass plains in the Derwent Bridge area, central Tasmania. The primary aim was to establish patterns associated with the impact of burning of buttongrass on pond biodiversity, community composition and ecological processes. This study forms a part of a study evaluating the effect of fire on the ecology of buttongrass systems, including terrestrial an aquatic, vertebrate and invertebrate fauna, and changes in vegetation and floristics (Driessen, RMC WHA management, Tasmania, unpub. data). These surveys had two components:

- Sampling of benthic fauna in ponds from plains with different fire ages - a ‘space for time’ design; and
- Sampling ponds before and after burning in a BACI (Before-After-Control-Impact) design.

All ponds were sampled quantitatively for benthic macroinvertebrates, zooplankton, phytoplankton, habitat characteristics, and were assessed for levels of benthic respiration and primary production. Only the results for benthic macroinvertebrates are reported here.

2. Study designs

2.1 Space for time study

Sampling was conducted in 11 buttongrass plains, with three ponds sampled per plain in spring (September-October) 2004. Evaluation of data and pond water levels over the 2004/05 summer indicated that the degree of permanence varied substantially between ponds within plains. In addition, preliminary sample analysis suggested that permanence was a strong driver of pond fauna and flora. Supplementary sampling was therefore conducted in additional ponds in spring 2005 in order to achieve a sample set which included both permanent and temporary ponds in each of the dominant fire age classes. Permanence was reassessed in each pond by inspection of water levels during the summer of 2005/06.

Fire ages were determined by Driessen (unpub. data) by dendrocrinology of regrowth shrub and tree vegetation. Each plain was assigned an age since the last significant burn, and ages were assigned to one of four fire age classes:

1 - 1 to 3 years;
2 – 5 to 8 yrs;
3 - 13 to 20 years; and
4 - 30 to 31 years.

Ponds were sampled once from each fire age class, with where possible, three permanent and three temporary ponds sampled per fire age class.

2.2 BACI design

Three ponds were selected within the ‘Little Navarre’ button grass plain (LNB), which was scheduled for burning in late spring (October) 2005. Sampling was conducted in September 2004, and again in November 2005 (2/11/05), several weeks after burning. Repeat sampling is scheduled for spring 2006. Sampling was conducted simultaneously on both occasions in three ponds within an adjacent buttongrass plain (LNC), which acted as a control. Both of these areas had been burnt 17 years before this study commenced.

These ponds ranged in size between 30 and 250 m^2 surface area, and 11 to 24 cm in mean water depth. These were not significantly different between the 2004 and 2005 sample periods (all $p > 0.4$ by paired t test). All ponds were permanent, soft bottomed, and had 80 to 100% macrophyte cover comprised of predominantly *Isolepis* or *Nymphoides*.

Characteristics of all ponds sampled in this study to date are shown in Table 1.

Table 1. Characteristics of all ponds sampled in fire effects study at Derwent Bridge in spring 2004 and 2005.

B'grss plain site	Pond	Fire Age class	Fire age	Year sampled	Plant cover	Permanence	Shade	Bottom	Conductivity	Area	Mean Depth	Vol	Dominant macrophyte
			Year		%				microS/cm	m^2	mm	m^3	
TREE	TREE1	4	31	2004	100	Temporary	Low	Hard	27.8	115	206	23.69	Isolepis
TREE	TREE2	4	31	2004	5	Temporary	Low	Hard	18.6	27	114	3.078	Isolepis
TREE	TREE3	4	31	2004	95	Temporary	Moderate	Hard	20.1	36	120	4.32	Isolepis
WEST	WEST1	1	2	2004	90	Temporary	Low	Soft	19.8	60	176	10.56	Myriophyllum
WEST	WEST2	1	2	2004	80	Temporary	Moderate	Hard	17.6	24	125	3	Isolepis
WEST	WEST3	1	2	2004	100	Temporary	Low	Soft	21	72	174	12.528	Sphagnum
KWPL	KWPL1	3	13	2004	95	Permanent	Low	Soft	20.4	60	276	16.56	Isolepis
KWPL	KWPL2	3	13	2004	95	Permanent	Low	Medium	20.4	70	230	16.1	Isolepis
KWPL	KWPL3	3	13	2004	95	Permanent	Low	Soft	22.8	175	238	41.65	Isolepis
SCRS	SCRS1	2	8	2004	80	Temporary	Low	Hard	26.8	57.5	170	9.775	Isolepis
SCRS	SCRS2	2	8	2004	95	Temporary	Low	Hard	29.3	36	124	4.464	Isolepis
SCRS	SCRS3	2	8	2004	100	Temporary	Low	Hard	20.1	180	160	28.8	Callitriche
SCRW	SCRW1	2	8	2004	95	Temporary	Low	Medium	21.6	80	100	8	Isolepis
SCRW	SCRW2	2	8	2004	100	Temporary	Low	Medium	23.7	110	198	21.78	Isolepis
SCRW	SCRW3	2	8	2004	100	Temporary	Low	Medium	26.2	38.5	152	5.852	Isolepis
KWCE	KWCE1	1	3	2004	80	Permanent	Low	Hard	18.4	133	602	80.066	Eleocharis
KWCE	KWCE2	1	3	2004	95	Permanent	Low	Soft	16	201	351	70.551	Isolepis
KWCE	KWCE3	1	3	2004	90	Permanent	Low	Soft	16.7	240	456	109.44	Isolepis
LNC	LNC1	3	17	2004	100	Temporary	Low	Soft	24.3	30	110	3.3	Nymphoides
LNC	LNC2	3	17	2004	95	Semipermanent	Low	Soft	20.1	120	152	18.24	Isolepis
LNC	LNC3	3	17	2004	80	Semipermanent	Low	Soft	23	161	161	25.921	Isolepis
LNB	LNB1	3	17	2004	80	Permanent	Low	Soft	25.4	254	200	50.8	Isolepis
LNB	LNB2	3	17	2004	100	Permanent	Low	Soft	20	90	217	19.53	Isolepis
LNB	LNB3	3	17	2004	80	Permanent	Low	Soft	29	45	172	7.74	Isolepis
PUMP	PUMP1	4	31	2004	75	Temporary	Low	Hard	27.8	10	142	1.42	Muc algae
PUMP	PUMP2	4	31	2004	100	Temporary	Low	Soft	28.9	60	113	6.78	Moss
PUMP	PUMP3	4	31	2004	100	Temporary	Low	Soft	25.9	60	124	7.44	Moss
NAVR	NAVR1	1	3	2004	100	Semipermanent	Low	Hard	19.3	17.5	145	2.5375	Sphagnum
NAVR	NAVR2	1	3	2004	60	Permanent	Low	Hard	17.9	35	195	6.825	Myriophyllum
NAVR	NAVR3	1	3	2004	95	Permanent	Low	Hard	15.7	78	208	16.224	Myriophyllum
TREW	TREW1	4	31	2004	100	Temporary	Moderate	Hard	34.8	100	180	18	Isolepis
TREW	TREW2	4	31	2004	100	Temporary	Low	Hard	34.4	72	156	11.232	Isolepis
TREW	TREW3	4	31	2004	100	Temporary	Low	Hard	30.9	48	154	7.392	Isolepis
KWCE	KWCE21	1	3	2005	30	Temporary	Low	Hard	20.6	6	82	0.492	Rush
KWCE	KWCE22	1	3	2005	5	Temporary	Low	Hard	19.5	7.5	144	1.08	Rush
SCRW	SCRW21	2	8	2005	100	Permanent	Low	Soft	26.1	60	173	10.38	Isolepis
SCRW	SCRW22	2	8	2005	80	Permanent	Low	Soft	26	104	193	20.072	Isolepis
SCRW	SCRW31	2	8	2005	100	Permanent	Low	Hard	25.3	32	155	4.96	Myriophyllum
PUMP	PUMP21	4	31	2005	85	Permanent	Low	Medium	35.2	150	230	34.5	Isolepis
PUMP	PUMP22	4	31	2005	85	Permanent	Low	Hard	42.9	1200	184	220.8	Triglochin
PUMP	PUMP31	4	31	2005	100	Permanent	Low	Medium	37.3	78	200	15.6	Moss
LNB	LNB21	1	0	2005	90	Permanent	Low	Soft	48	32	170	5.44	Rush
LNB	LNB22	1	0	2005	90	Permanent	Low	Hard	40.6	48	195	9.36	Rush
LNB	LNB21b	1	0	2005	40	Temporary	Low	Medium	52	60	150	9	Rush
LNB	LNB22b	1	0	2005	10	Temporary	Low	Hard	55.1	24	132	3.168	Rush

3. Sampling methods

Sampling was conducted in spring 2004 or 2005. A representative area of 4 m x 30 cm was sampled along the centre line of pond's main axis sampled using a standard 250 micron mesh kick net sampler, by kick and comprehensive sweep washing of the benthos into the net. Samples were preserved in 10% formalin solution, prior to subsampling to 20% (with a Marchant box subsampler, Marchant 1989), and sorting by hand under magnification. All taxa were enumerated and identified to family level.

4. Data analysis

4.1 Space for time

Sample data was analysed by multivariate and univariate methods. All pond sample data was entered into Primer software package and used to derive a Bray Curtis similarity matrix based on square root transformed abundance data for all taxa. Non non-hybrid multidimensional scaling ordination was conducted on the matrix, and patterns inspected in the resulting ordination plots. ANOSIM (multivariate analysis of variance) was conducted on the multivariate data, with 1000 permutations, using both fire age class and permanence rating as factors. SIMPER analysis was used to identify those taxa most responsible for differences between groups.

Univariate (one way analysis of variance was used to assess the null hypothesis of no difference in abundance or diversity of macroinvertebrates between various fire age classes.

4.2 BACI design

Pond sample data was converted to absolute differences in abundance or diversity between pre- and post-burn sample periods. These differences were then compared between Impact (LNB) and Control (LNC) locations by one way non-parametric Kruskal Wallis test.

5. Results

5.1 Pond permanence

A total of 17,135 individuals were collected and identified for the space for time pond survey, with a total of 47 taxa from the 45 ponds sampled.

Significant multivariate differences were detected by ANOSIM ($p < 0.001$) between permanent and temporary pond faunas, and can be seen in the MDS ordination (Figure 1). These differences were characterised by slightly greater diversity in permanent ponds with 18 taxa vs 15.5 in temporary ponds ($p = 0.025$ by one way ANOVA). Abundance and diversity data for the study ponds is shown in Table 2.

Permanent ponds also had significantly higher abundances of mites (Acarina), small crustaceans (Ostracoda, Copepoda), Lestidae damselflies (which were found in 18 out of 19 permanent ponds, but only 4 out of 23 temporary ponds), Synthemistid dragonflies, Corixidae, midges (Chironomidae, especially of the sub-family Tanypodiinae) and Leptocerid caddis larvae (all $p < 0.05$ by ANOVA).

Temporary ponds had higher abundances of Culicidae (mosquito larvae and pupae – which were found in 19 out of 23 temporary, but only 3 out of 19 permanent ponds), and of hydroptilid and dytiscid beetles (all $p < 0.05$ by ANOVA). These taxa are characteristic early colonizers of newly wetted environments.

5.2 Space for time

Significant differences in macroinvertebrate community composition between fire age classes were observed for temporary ponds, but not for permanent ponds. Temporary ponds of fire age class 1, were significantly different by ANOSIM ($p = 0.05$) from all other fire age classes (Figure 2). These differences were characterised by higher total abundances ($p = 0.009$ by one-way ANOVA), and of abundances of Chironomid midge larvae ($p = 0.001$ by one-way ANOVA, Figure 2). Mean overall abundances for macroinvertebrates in temporary ponds of fire age class 1 were 3,232/m^2 of benthic area compared with an overall mean of 1,732/m^2 for all other fire age classes. There were no significant differences in diversity between fire age classes.

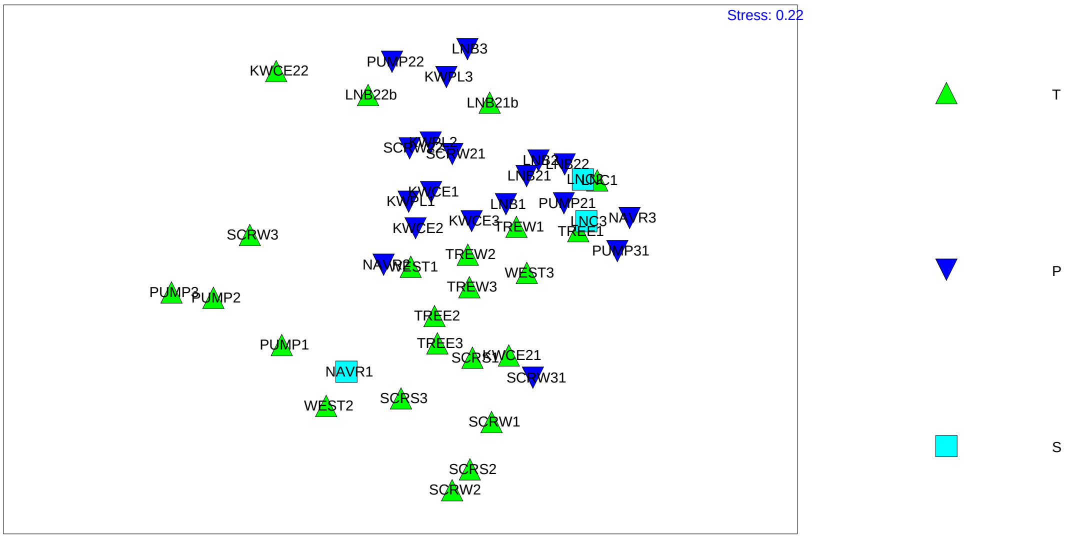

Figure 1. MDS ordination of benthic macroinvertebrate data from all ponds sampled in the space for time study at Derwent Bridge. Marked differences between permanent and temporary ponds can be seen. T = temporary, P = permanent, S = semi-permanent.

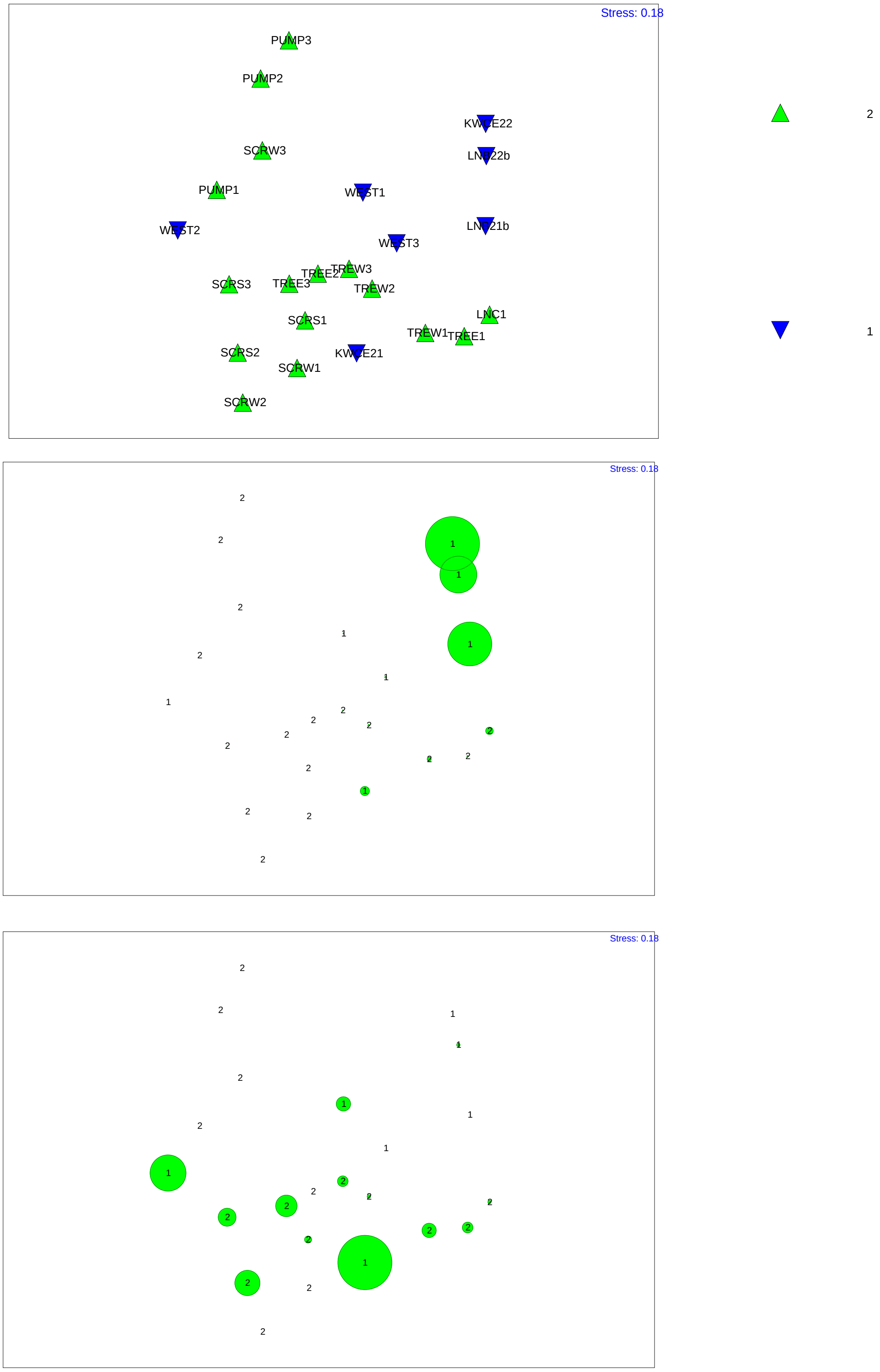

Figure 2. MDS ordinations of temporary ponds (space for time study) showing compositional differences by fire age class (1 and ≥2). The middle and lower ordinations indicate relative abundance of chironomiin and orthoclad midges respectively, by bubble size, and fire age class.

Table 2. Abundance and diversity of macroinvertebrates and tadpoles in buttongrass ponds sampled in th e space for time study in spring 2004 or 2005. Abundances are n per 0.24 m ^{2} pond area.

	Site	TREE			WEST			KWPL		
	Pond	1	2	3	1	2	3	1	2	3
	Date	12/10/2004	12/10/2004	12/10/2004	6/10/2004	6/10/2004	6/10/2004	10/11/2004	10/11/2005	10/11/2005
Class/Order	**Family**									
Macroinvertebrates										
Nematoda		1		3			22	6		
Turbellaria						1		1		
Oligochaeta		3	91	171	71	278	20	115	20	4
Bivalvia	Sphariidae	4						2	67	25
Gastropoda	Planorbidae							6	1	
	Physidae	47								
Acarina		3	1	5	12		35	6	1	1
Amphipoda	Paramelitidae									3
	Ceinidae							8	2	
	Neoniphargidae				79		147	1	1	
Isopoda	Janiridae									
	Phreatoicidae		18	2				35	67	93
Ostracoda		359	1	7	83	30	50	12	26	40
Copepoda		1	13	2	1	1	39	17	5	2
Cladocera		108	121	117	9	1	119	20	22	
Colembolla										
Plecoptera	Gripopterygidae	8			7		1	5	3	1
	Notonemouridae	27	3	1	18		29	5		5
Ephemeroptera	Leptophlebiidae									
Odonata	Coenagrionidae	4								
	Lestidae	7						2	2	21
	Synthemistidae						6	2		2
	Hemicorduliidae				2					
Hemiptera	Corixiidae	1						2	4	
	Notonectidae									
Diptera	Chironominae	32	5	3	21		39	6	25	7
	Orthocladiinae	3		6	4	10		33	53	2
	Tanypodinae	121	8	8	85	18	75	11	18	53
	Tipulidae					1				
	Ceratopogonidae			1	3	140		21	7	3
	Chaoboridae									
	Culicidae	10	10	22	33	24	26			
	Empididae							1		
	Tanyderidae									
	Pupae	5	10	27	19	3	25		1	1
Trichoptera	Atriplectidae									
	Leptoceridae	12	21	1	5	1	4	8	20	31
	Hydroptillidae	12								
	Plectrotarsidae									
Coleoptera	Dytiscidae adult		9			2				
	Dytiscidae larvae	16	3	4	1	3	6	7	10	1
	Hydrochidae adult									
	Hydrophilidae adult						1			
	Hydrophilidae larvae	1								
	Scirtidae larvae									
	Hydraenidae adult									
	Curculionidae adult									
	Total abundance	**785**	**314**	**380**	**453**	**513**	**644**	**332**	**355**	**295**
	N Taxa	**22**	**14**	**16**	**17**	**14**	**17**	**24**	**20**	**18**
Frogs										
ANURA	Hylidae			1						
	Myobatrachidae									

	Site	SCRS			SCRW			KWCE			LNC		
	Pond	1	2	3	1	2	3	1	2	3	1	2	3
	Date	11/11/2004	11/11/2004	11/11/2004	11/11/2004	11/11/2004	11/11/2004	5/10/2004	5/10/2004	5/10/2004	7/09/2004	7/09/2004	7/09/2004
Class/Order	**Family**												
Macroinvertebrates													
Nematoda				1	5							21	17
Turbellaria				1				2					
Oligochaeta		30	359	421	66	29	8	98	36	42	18	22	36
Bivalvia	Sphariidae							17			4		
Gastropoda	Planorbidae							13		2			
	Physidae										18		
Acarina		13	8	14				2		41	13	84	22
Amphipoda	Paramelitidae										1	1	
	Ceinidae												
	Neoniphargidae							2		13			
Isopoda	Janiridae												
	Phreatoicidae	6				2	10				2	6	5
Ostracoda		3		6			1	15	3	86	373	196	259
Copepoda		8		1	9			9	13	40		43	48
Cladocera		365	152	6	225	53	1	7	35	15	142	70	303
Colembolla		22	28	1									
Plecoptera	Gripopterygidae			1				2					
	Notonemouridae				1			2		2	95	18	11
Ephemeroptera	Leptophlebiidae												
Odonata	Coenagrionidae								1		9	1	2
	Lestidae				1			3	3	18	10	25	43
	Synthemistidae	1		2		3	1	5	1	1	6	3	6
	Hemicorduliidae										4		
Hemiptera	Corixiidae			1						1			1
	Notonectidae												
Diptera	Chironominae	4	3	10	5	3	2	56	71	99	143	103	85
	Orthocladiinae	2	7	5						5	1	1	98
	Tanypodinae	21	2	17	6		18	91	54	32	242	316	330
	Tipulidae								1				
	Ceratopogonidae			1				42	9	5	1	2	6
	Chaoboridae												
	Culicidae	7	5	3	10					1	23	1	1
	Empididae												
	Tanyderidae												
	Pupae	29	11	16	37	5	6	4	4	22			27
Trichoptera	Atriplectidae												
	Leptoceridae	8					3	6	2	2	72	136	101
	Hydroptillidae		1	12							1		
	Plectrotarsidae												
Coleoptera	Dytiscidae adult	10	2		1	7	3				1		
	Dytiscidae larvae	53	52	42	115	33	9				6	3	4
	Hydrochidae adult												
	Hydrophilidae adult		3	1									
	Hydrophilidae larvae											1	
	Scirtidae larvae		1										
	Hydraenidae adult		1										
	Curculionidae adult							1					
	Total abundance	**582**	**635**	**562**	**481**	**135**	**62**	**377**	**233**	**427**	**1185**	**1053**	**1405**
	N Taxa	**16**	**15**	**20**	**12**	**8**	**11**	**19**	**13**	**18**	**22**	**20**	**20**
Frogs													
ANURA	Hylidae	30	2	5	15	1	2						
	Myobatrachidae												

	Site	LNB			PUMP			NAVR			TREW		
	Pond	1	2	3	1	2	3	1	2	3	1	2	3
	Date	8/09/2004	8/09/2004	8/09/2004	6/10/2004	6/10/2004	6/10/2004	7/10/2004	7/10/2004	7/10/2004	13/10/2004	13/10/2004	13/10/2004
Class/Order	**Family**												
Macroinvertebrates													
Nematoda			18							5		2	
Turbellaria		4											3
Oligochaeta		18	21		40	26	7	209	33	91		66	89
Bivalvia	Sphariidae			8							2		
Gastropoda	Planorbidae			1							4	3	2
	Physidae												
Acarina		6	15			5	7	239		671		1	
Amphipoda	Paramelitidae												
	Ceinidae												
	Neoniphargidae					3	18	8					
Isopoda	Janiridae											1	
	Phreatoicidae	2	1	3						27		52	3
Ostracoda		71	18	11	3	4	1	1	8	224	21	18	30
Copepoda		2	101	4				5		42		11	
Cladocera		99	29		8				6	139	186	112	158
Colembolla													
Plecoptera	Gripopterygidae			1									
	Notonemouridae	6	2	26					5		7	1	28
Ephemeroptera	Leptophlebiidae	2	2										
Odonata	Coenagrionidae												
	Lestidae	32	8	3					8	15	3		
	Synthemistidae		4						2	19	1		
	Hemicorduliidae					1	3		1	1			
Hemiptera	Corixiidae								3	4			
	Notonectidae									1			
Diptera	Chironominae	44	79	174	1			3	23	442	79	38	17
	Orthocladiinae		157					9		25	4	1	3
	Tanypodinae	135	180	54	22	22	39	70	70	439	41	61	45
	Tipulidae												
	Ceratopogonidae	1			1			1	2	15			1
	Chaoboridae				1								
	Culicidae			3	9	5	5	38	17			1	4
	Empididae												
	Tanyderidae										1		
	Pupae	1	22		1	5	12	46	35	2	31	2	11
Trichoptera	Atriplectidae									4			
	Leptoceridae	16	32	8		4		1	1	4	14		12
	Hydroptillidae			1							1	1	1
	Plectrotarsidae					1							
Coleoptera	Dytiscidae adult								1			3	2
	Dytiscidae larvae	2		3	3			2	6	6	12	11	2
	Hydrochidae adult												1
	Hydrophilidae adult				1								
	Hydrophilidae larvae												
	Scirtidae larvae					6							
	Hydraenidae adult												
	Curculionidae adult												
	Total abundance	**441**	**689**	**300**	**90**	**82**	**92**	**632**	**221**	**2176**	**407**	**385**	**412**
	N Taxa	**16**	**16**	**14**	**11**	**11**	**8**	**13**	**16**	**20**	**15**	**18**	**18**
Frogs													
ANURA	Hylidae									32			2
	Myobatrachidae											3	

5.2 BACI design

A total of 8,492 individuals were collected and identified for the BACI pond survey, with a total of 38 taxa from the 6 ponds sampled.

Marginally significant differences in the before-after differences in overall abundance and diversity of benthic macroinvertebrates were detected (both p = 0.072, and 0.05 respectively by Kruskal Wallis test) between LNB and LNC ponds. These differences were characterised by a decline in overall abundance and particularly the abundance of chironomid midges (particularly tanypodinae) and ostracod crustaceans at control (LNC) ponds between 2004 and 2005 (Table 3, Figure 3). This decline was not observed in burnt ponds (LNB), which increased in overall abundance and in diversity after burning relative to the control (LNC) ponds. An average decline of 2.7 taxa was observed for LNC ponds, compared to an increase by 1.7 taxa at LNB ponds. The differences in pre-post change in abundance of in tanypodiinae and ostracoda were both significant at the 0.05 level (Kruskal Wallis test). These results indicate a short term response in pond fauna to burning, which is represented by a relatively higher abundance of midges and ostracods.

The two LNB ponds with the greatest changes relative to the control LNC ponds also had the greatest increases in water column conductivity between sampling events in 2004 and 2005 (by 9.9 and 29.1 microS/cm, compared with an average of 4.9 microS/cm for all other ponds).

Table 3. Abundance (n per 0.24 m^2 pond area) and diversity of macroinvertebrates and tadpoles in buttongrass ponds sampled in the BACI study in spring 2004 and 2005.

	Site	LNC			LNB			LNC			LNB		
	Pond	1	2	3	1	2	3	1	2	3	1	2	3
	Date	7/09/2004	7/09/2004	7/09/2004	8/09/2004	8/09/2004	8/09/2004	2/11/2005	2/11/2005	2/11/2005	2/11/2005	2/11/2005	2/11/2005
Class/Order	**Family**												
Macroinvertebrates													
Nematoda			21	17		18			6				
Turbellaria					4						2		
Oligochaeta		18	22	36	18	21		13	10	44	13		5
Bivalvia	Sphariidae	4					8	1					5
Gastropoda	Planorbidae						1						
	Physidae	18						27					2
Acarina		13	84	22	6	15		7	1	10	3	8	
Amphipoda	Paramelitidae	1	1						1				
Isopoda	Phreatoicidae	2	6	5	2	1	3	5	66	33	11	23	19
Ostracoda		373	196	259	71	18	11	51	60	158	25	1	42
Copepoda			43	48	2	101	4			61		3	21
Cladocera		142	70	303	99	29		176	110	112	78		4
Plecoptera	Gripopterygidae						1						3
	Notonemouridae	95	18	11	6	2	26	1	4				16
Ephemeroptera	Leptophlebiidae				2	2						1	
Odonata	Coenagrionidae	9	1	2							2		8
	Lestidae	10	25	43	32	8	3	17	28	18	24	37	3
	Synthemistidae	6	3	6		4		14				2	
	Hemicorduliidae	4											
Hemiptera	Corixiidae			1						1	10		
	Veliidae							1					2
Diptera	Chironominae	143	103	85	44	79	174	26	46	184	273	8	89
	Orthocladiinae	1	1	98		157				1		2	
	Tanypodinae	242	316	330	135	180	54	121	176	113	136	179	123
	Ceratopogonidae	1	2	6	1			1	6	2	1	2	6
	Culicidae	23	1	1			3						
	Pupae			27	1	22		2	3	2	4		5
Trichoptera	Atriplectidae												2
	Leptoceridae	72	136	101	16	32	8	90	70	60	14	16	206
	Hydroptillidae	1					1						5
	Trichop pupae											1	
Coleoptera	Dytiscidae adult	1						2		1	1		
	Dytiscidae larvae	6	3	4	2		3	3	4				3
	Hydrochidae adult							2	2	1			
	Hydrophilidae larvae		1										
	Curclionidae larvae									1			
	Gyrinidae larvae										1		
	N Taxa	**22**	**20**	**20**	**16**	**16**	**14**	**19**	**17**	**18**	**17**	**14**	**20**
	Totabund	**1185**	**1053**	**1405**	**441**	**689**	**300**	**560**	**594**	**805**	**603**	**288**	**569**
Frogs	Hylidae												
	Myobatrachidae								1	3	5	5	

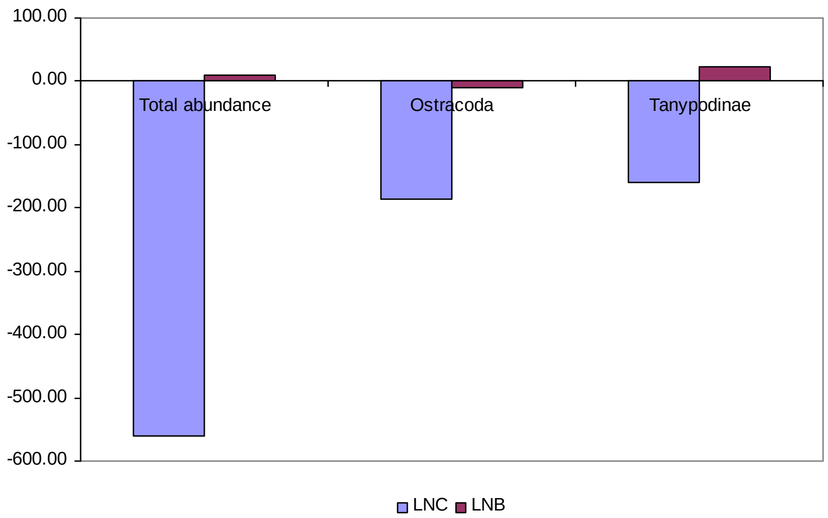

Figure 3. Mean change in pond macroinvertebrate abundance between 2005 and 2004 for control (LNC) and burnt (LNB) buttongrass plains.

6. Discussion

This preliminary analysis has revealed that:

- Buttongrass ponds contain a diverse and often abundant macroinvertebrate fauna;
- The faunal composition is strongly influenced by the degree of permanence of the pond ie whether it dries up seasonally or is permanently wet;
- Ponds are affected by buttongrass burning for the first year to three years after burning;
- The effect varies between individual ponds, and is affected by pond permanence and probably the local intensity of the burn;
- Burning causes overall abundance and diversity of macroinvertebrates to temporarily increase, with the main response being an increase in density of chironomid midge larvae.
- The burning effect is most evident in temporary ponds, but is not detected in ponds of fire ages of 5 years and greater.

Sampling of the LNB and LNC ponds will be repeated in late 2006 (one year after burning) and again in the future to assess the duration of the effects observed here.

Results of additional sampling for zooplankton, benthic respiration, and stable isotopes will be reported at a later date.

7. References

Marchant R 1989. A subsampler for samples of benthic invertebrates. Aust. Soc. Limnol. Bull. 12, 49-52.